





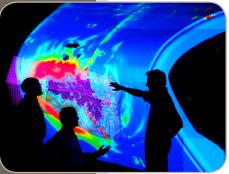


Exceptional service in the national interest

# Strategic Plan

FY14-FY18







8/26/2014







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## Sandia National Laboratories

# STRATEGIC PLAN

# FY14-FY18

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Paul Hommert

President and
Laboratories Director

"...we recognized that, to amplify our national security impact, we needed to deeply reexamine our mission space and its relationship to the foundational capabilities that enable our mission success today and tomorrow."

# Message from the President

Welcome to our *FY14*–*FY18 Strategic Plan*, an important update to the *FY12*–*FY16 Strategic Plan* we issued two years ago. Before I discuss the changes that motivated this update, let me emphasize what has not changed. At the highest level, our plan is built around five strategic objectives. We believe those five objectives continue to provide the right framework for securing the future of the Laboratories as a major science and technology contributor to the nation's national security. In fact, it is my belief that consistency at the strategic level has allowed our plan to become a living document deepened by goals and milestones. By reaching from the strategic level to actionable milestones, which change every year, we ensure that our tactical actions are strategically aligned. We have published milestone brochures in fiscal years 2012, 2013, and 2014 to emphasize our commitment to "living the plan."

It is the success of our work over the past two years guided by the plan we published in FY12 that has prompted this update. In that original plan, we recognized that, to amplify our national security impact, we needed to deeply reexamine our mission space and its relationship to the foundational capabilities that enable our mission success today and tomorrow. What emerged from that work is a new framework for describing the mission and capability space of Sandia National Laboratories, the nation's most diverse national security laboratory—as will become explicit from the pages to follow. Describing that framework represents the centerpiece for this update, and realizing the future envisioned by the new framework brings new clarity to our efforts to amplify our national security impact. I encourage you (whether you work at Sandia or are a stakeholder) to read our description of mission and capability and provide us feedback about how well it embodies our 21st century national security laboratory that has so dramatically evolved over almost seven decades while maintaining its fundamental responsibility to the nation's nuclear deterrent. To discuss the new Laboratories' framework and all its components, we divided the volume into two parts. Part I begins with our rich legacy and then delves into a presentation of our strategic framework that secures our relevance into the future. Part II provides needed detail about our mission areas and foundation.

For the leadership of Sandia and for me, the *Strategic Plan* has become an essential compass that guides us during times of unprecedented uncertainty (fiscal challenges, deterrence policy debate, contractual uncertainties, examination of the laboratory system, etc.). Year after year, holding ourselves accountable to a consistent direction has allowed us to see real, measurable progress on a journey of excellence. It has also reminded us just how high we have set the bar of excellence for ourselves. You will see in our plan that more progress is needed in areas such as quality, safety culture, and realizing our strategic mission direction. I am more confident than ever that we will continue our journey of progress not only because we have a plan, but also because I have the benefit of knowing the people of the Laboratories who execute this plan, their commitment, talent, and dedication to render exceptional service in the national interest.

If you've read this message, then I hope it entices you to read further. I believe you will see a Sandia striving to be a more integrated institution with a unique character, often described as rooted in rigor, pragmatism, patriotism, and a desire to push the frontiers of science and technology as far as they need to go in response to the national security realities of today and tomorrow.

—Paul Hommert

# STRATEGIC PLAN FY14-FY18

# PART I

A New Framework for the Laboratories From an enduring legacy to a strategic future



#### **Enduring Legacy**

The beginnings of Sandia National Laboratories are deeply rooted in the Manhattan Project, which produced the first atomic bombs during World War II. In 1949, Sandia became an independent laboratory with responsibility for nuclear weapons ordnance engineering and production coordination. This year, we will celebrate 65 years of a distinguished history that reflects America's evolving national security needs.

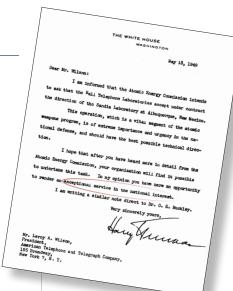
During the Cold War, Sandia played a pivotal role in ensuring the safety, security, and reliability of the nation's growing nuclear arsenal. We developed unique expertise in systems engineering with responsibility for the research, design, and development of more than 90 percent of the approximately 6,500 nonnuclear components of a modern nuclear weapon. Among these components are security systems, arming and fuzing mechanisms, safety systems, neutron generators, gas transfer systems, and instrumentation.

In 1992, the United States stopped producing new warheads and halted nuclear testing, the ultimate guarantee of weapons reliability and performance. The next three years in the history of the nuclear weapons enterprise were challenging, as Sandia, Los Alamos, and Lawrence Livermore national laboratories were laboring over an approach to certify the safety, security, and reliability of the nation's nuclear stockpile without yield-producing nuclear tests. For the nation's stockpile stewards, the change to a nontesting environment was, at the time, as ground-heaving intellectually as the nuclear tests had been literally. It was at that time that a formal program in science-based stockpile stewardship came into being, which would change the course of the nuclear weapons program and respond to the political realities of the country and the world. Within that program, the three national laboratories developed new predictive capabilities and experimental facilities to evaluate the weapons and determine their state of health. Ultimately, these stockpile stewards have the grave responsibility of ensuring that nuclear weapons will always work as intended when commanded and authorized by the president of the United States and they must never detonate under any other circumstances. This is a tall order, and it is at the core of Sandia's essence.

At Sandia, we have used our advanced computer capabilities to simulate weapon performance and our world-class facilities to conduct accurate nonnuclear tests of whole weapons systems in order to validate the computer simulations. One such facility is the Z machine, brought online in 1996 and upgraded in 2006. It is the world's most energetic x-ray source (radiates as much as 3 megajoules of energy) and has been used to study the physics of nuclear reactions and weapon survivability issues and high energy density physics, including fusion, relevant to nuclear weapons.

Currently, Sandia is in full-scale engineering development on three simultaneous weapon modernization programs—the B61 life extension program, W88 ALT 370, and Mark 21 Fuze Replacement—bearing responsibility for hundreds of highly specialized components with extremely high reliability specifications and unique, often very harsh, environmental requirements, as well as for systems engineering and integration of the nuclear weapons into the stockpile.

Over the decades, there has been a natural symbiotic relationship between our core nuclear weapons mission and our broader national security mission areas. The core nuclear weapons mission enables the broader national security mission areas and is, in turn, enabled by them.



Exceptional service in the national interest

The nuclear weapons mission is our reason for being; it is what makes us unique, and it creates a foundation from which we leverage our capabilities . . .

Today, Sandia delivers consistently on the commitments to the nuclear weapons program by coupling that work with the synergistic interagency work that attracts top talent, hones our skills, and provides stability to our broader national security role. Sandia has opened its doors to a new generation of scientists and engineers who come here, as did their predecessors, to serve the nation and push the boundaries of solutions to urgent and important technical problems. We are proud of our heritage and national security role.

#### **Core Purpose**

To render "exceptional service in the national interest" has been Sandia's core purpose since 1949. The Lab's original mission, to provide engineering design, systems engineering, and integration for the nonnuclear components of the nation's nuclear weapons, continues today. The nuclear weapons mission is our reason for being; it is what makes us unique, and it creates a foundation from which we leverage our capabilities and provide support to address other national security challenges.

#### **Vision**

On behalf of our nation, we anticipate and solve the most challenging problems that threaten security in the 21st century.

When we achieve this vision, we are widely recognized as a national leader in preventing technological surprise, anticipating threats, and providing innovative, science-based systems engineering solutions to our nation's most challenging national security problems.

The excitement and importance of our work, our exemplary work environment, our partnerships with academia, industry, government, and other partners, and our record of historic contributions, help us attract exceptional staff. Our employees are recognized by their professional peers for their outstanding contributions, and our institution is managed in a way that inspires confidence.

#### Mission

Our unique mission responsibilities in the nuclear weapons (NW) program create a foundation from which we leverage capabilities, enabling us to solve complex national security problems.

As a multidisciplinary national laboratory and federally funded research and development center (FFRDC), Sandia accomplishes tasks that are integral to the mission and operation of our sponsoring agencies by

- anticipating and resolving emerging national security challenges
- innovating and discovering new technologies to strengthen the nation's technological superiority
- creating value through products and services that solve important national security challenges
- informing the national debate where technology policy is critical to preserving security and freedom throughout our world

As an FFRDC for the National Nuclear Security Administration (NNSA), we have a long-term relationship with our sponsor. This creates an environment that supports our fields of expertise, enables us to maintain our objectivity and independence, and allows us to be familiar with our

As an objective, independent, and trusted advisor, we draw from our deep science and engineering experience to anticipate, innovate, create, and inform the policy debate for decision makers.

sponsor's mission. We bring the FFRDC culture to all our federal sponsors to provide long-term support, solutions to existing problems and emerging threats, and quick-response capabilities. As an objective, independent, and trusted advisor, we draw from our deep science and engineering experience to anticipate, innovate, create, and inform the policy debate for decision makers.

# WALUES -

# We cultivate the development of all members of our workforce and commend their world-class accomplishments.

#### **Values**

Sandia has five core values that inform our daily decisions, shape our performance, and enable us to achieve success as one laboratory with one national security mission.

We serve the nation by responding to the requests of our customers and by anticipating our country's future needs. We complete our mission even in the face of challenges and ambiguity, seizing every opportunity to "render exceptional service in the national interest."

We deliver with excellence by meeting our commitments, hiring the best, working collaboratively, and committing ourselves to continuous improvement to advance the frontiers of science, engineering, and technology.

We respect each other by cherishing the intellect, skills, diversity, flexibility, and passion of our coworkers. We cultivate the development of all members of our workforce and commend their world-class accomplishments.

We act with integrity by working consistently within our principles, by telling the truth, and complying with the law.

We team for great results by sharing a common vision and by fostering an attitude of mutual respect with all our partners. We combine our talents to benefit each other and our customers, working to ensure that everyone gains from our collective achievements.

#### **Environment and Outlook**

#### **External View**

Since 2001, the external environment has been marked by a foreign policy dominated by two wars and the global war on terrorism, instabilities affecting critical oil supplies, changes in the makeup of Congress, a sluggish economy with high unemployment, calls for substantial cuts in federal spending, and new policy agreements that are reshaping America's nuclear deterrent. The political environment in Washington has become more volatile, while the federal budget deficit is prompting budget cuts that affect long-term federal spending on defense and energy.

Despite these challenges, our nation has been, and continues to be, fully committed to the U.S. nuclear deterrent as reflected by the near- and long-term nuclear weapons policy in the *Nuclear Posture Review* and collective guidance for implementation provided through the *Stockpile Stewardship and Management Plan*, the updated *Section 1251 Report*, and the Obama administration's annual budget request to Congress. In this new era, the nuclear

Accomplishing the significant work scope on the stockpile, which is dominated by Sandia componentry, within a constrained budget environment presents an important challenge and opportunity...

The larger national security community has affirmed time and again the need to better engage the Laboratories' unique talents and capabilities...

weapons enterprise must address three imperatives: continue to further the tools of stewardship, upgrade production infrastructure, and modernize the nuclear stockpile. The contributions of Sandia are crucial to the success of these imperatives. Accomplishing the significant work scope on the stockpile, which is dominated by Sandia componentry, within a constrained budget environment presents an important challenge and opportunity requiring strong leadership and innovation to fulfill our nuclear weapons responsibilities.

The larger national security community has affirmed time and time again the need to better engage the Laboratories' unique talents and capabilities for the broad set of security challenges confronting the nation. The National Nuclear Security Administration (NNSA), the Department of Homeland Security (DHS), the Department of Defense (DoD) and the Office of the Director of National Intelligence (ODNI) signed a governance charter that provides a framework for the participating agencies to coordinate shared, long-term planning for the science, technology,

and engineering capabilities of the Department of Energy (DOE) national laboratories. This agreement paved the way for breaking down barriers that impact our ability to engage with the national security community more broadly.

Congress created a twelve-member advisory panel to examine the governance of the nuclear security enterprise and to make recommendations for revising the governance structure, mission, and management of the nuclear security enterprise. In addition, the DOE is examining the governance framework to ensure the enterprise provides a high level of performance in operations, cost efficiency, and productivity. The nature and diversity of Sandia's work provides an outstanding opportunity for us to demonstrate leadership of the DOE's governance reform initiative.



About 25% of our employees were hired in the last three years, and approximately 50% of our technical hires came from the top 25 schools in the nation.

#### **Internal View**

When the FY12–FY16 Strategic Plan was deployed, numerous challenges affected the Laboratories, including, but not limited to, funding uncertainties that constrained our ability to maintain, sustain, and invest in our capabilities; an increased number of retirements and an expanding program portfolio requiring replacements of key staff and managers; and a need to revise our job structure and compensation system to better recognize the wide range of professions and skills required to execute the Laboratories' mission and improve market alignment. To address financial challenges, strategically invest in our infrastructure, and offset projected increases in pension contributions and employee health care insurance, Sandia closed new enrollment into the pension plan, changed the pension formula to reduce liabilities, introduced health care cost sharing for our employees, and modified our retiree benefit offerings. We not only managed costs successfully, but also continued to attract exceptional talent to the Laboratories to support our nuclear weapon life extension programs. About 25% of our employees were hired in the last three years, and approximately 50% of our technical hires came from the top 25 schools in the nation. We exceeded national benchmarks for employee diversity and achieved 98% retention. Additionally, we implemented an effective strategic market-based compensation system to ensure salary competitiveness and a transparent employee evaluation system.

In response to continued funding uncertainties, Sandia is using its operational innovation program to generate significant cost efficiencies and is on track to reduce energy consumption by 25% by the end of FY17 (FY11 baseline). As we strive to meet ever-demanding expectations of our national security customers, the health and safety of our workforce remains paramount. We are actively integrating the concepts of engineered safety into our daily work in order to advance the Laboratories' safety culture. To ensure that we continue to deliver on our commitments and that all intended outcomes are achieved consistently and predictably, Sandia will continue to focus on integrating assurance into mission work. In FY14—FY18, Sandia will enhance its quality management system and deepen quality implementation. Greater attention to assurance, coordination, and resulting behaviors will inspire confidence in our demonstrated ability to meet mission commitments, including high-quality products and services, safe operations, information security, and environmental protection, consistently and predictably. On the foundation of our assurance culture, Sandia can operate under a new governance and oversight model, allowing us to manage our operations with greater autonomy.

As we strive to meet everdemanding expectations of our national security customers, the health and safety of our workforce remains paramount.

#### LABORATORIES' FRAMEWORK

Today, Sandia faces new challenges resulting from the totality of our work. Sandia is engaged in the significant demands of the nation's nuclear weapons modernization program while continuing to conduct an extraordinary range of activities in broader national security areas. More than ever, we must effectively manage the Laboratories' capabilities and mission commitments to strengthen the core mission work while simultaneously continuing to advance our other missions. We developed a new Laboratories' framework to capture the entirety of our work while positioning the Laboratories to evolve and bring greater stability to our broad national security role.

The new Laboratories' framework, shown in Figure 1, provides a basis for describing Sandia's mission and capability space and for prioritizing the work of the Laboratories. Three key characteristics—synergy with nuclear weapons capabilities, national security impact,

and strategic value to the nation to ensure Sandia's enduring impact—were used to identify seven integrated missions, in addition to the nuclear weapons core mission. Together, all eight mission areas (MAs) are supported by a robust foundation that enables Sandia's success as a sustainable 21st century, broad-spectrum national security laboratory.

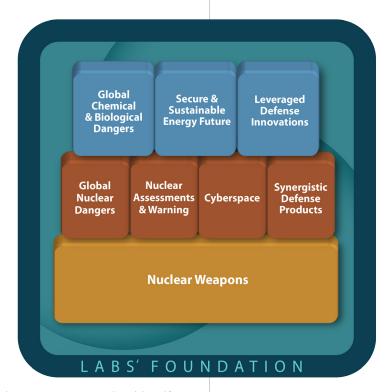


Figure 1. Laboratories' Framework

Sandia's eight MAs bring new focus to the work in the broader national security mission space that is required to effectively execute the nuclear weapons mission.

#### **Mission Areas**

Sandia's eight MAs bring new focus to the work in the broader national security mission space that is required to effectively execute the nuclear weapons mission. Four of these MAs—reducing global nuclear dangers, providing nuclear assessments and warning, defending and dominating in cyberspace, and maintaining U.S. defense technological superiority through synergistic products—are strongly interdependent with, and essential to, sustaining Sandia's ability to fulfill its nuclear weapons mission. In turn, the core nuclear weapons mission enables these broader national security missions, allowing Sandia to leverage the broad scope of the work and thus provide a unique value to the nation. The four MAs, when combined with the nuclear weapons MA, effectively define a new core for Sandia National Laboratories.

Three additional MAs—maintaining U.S. defense technological superiority through leveraged innovations, reducing global chemical and biological dangers, and ensuring a secure and sustainable energy future—are critical to our national security and enhance our capabilities. Sandia provides vital expertise, technologies, and facilities to address these three MAs, which are distinguished from the four discussed above in that their synergy with the nuclear weapons MA is more effectively managed by connectivity in capabilities rather than direct products. However, they do have direct product connectivity to the broader core defined above. By working in these MAs, Sandia ensures the maximum leverage of our core capabilities to the benefit of solving national security challenges. Therefore, the nation needs Sandia to sustain and enhance these MAs.

To learn more about all the MAs turn to Pages 26–30 for detailed descriptions.

#### Laboratories' Foundation

Sandia's ability to deliver on its national security mission is built on a strong foundation, which owes its origin to the early days of the Laboratories' nuclear weapons program. Within the foundation, shown in Figure 2, are several vital resources—people, research, and facilities and tools—in which we invest to build a unique set of capabilities that enables mission delivery.



Figure 2. Laboratories' Foundation

*People*—We hire world-class talent committed to solving the nation's most challenging problems. We maintain a technical base of scientists and engineers who engage in all aspects of our mission and a professional base of business and operations personnel that support our mission.

**Research**—We inform and differentiate our work for our sponsors by using a deep discipline-based approach to research in critical areas, as well as selected areas of interdisciplinary focus.

*Facilities and Tools*—We steward our unique facilities and assemble additional state-of-the-art and highly differentiated facilities, as needed for our mission. We also maintain, develop, and procure the physical and computational tools we need to enhance our capabilities.

**Capabilities**—The resources just described are the quintessential elements that generate a unique set of technical competencies that we nurture and advance to provide an exceptional value to the nation. Our capabilities are illustrated at the center of the Laboratories' foundation because, being based

on the resources just described, they define us for who we are. Listed below, Sandia's key technical capabilities have proved their uniqueness time and time again, through decades of our experience in delivering to customers.

- · High-reliability engineering
- Sensors and sensing systems
- Cyber technology
- · Reverse engineering
- Micro and nano devices and systems
- Modeling and simulation and experiment
- Natural and engineered materials
- Pathfinders
- Safety, risk, and vulnerability analysis

These capabilities are shaped by our technical approach to the work with which the nation has entrusted us. Ultimately, the different, yet interconnected, facets of our approach define, in part, who we are as a laboratory.

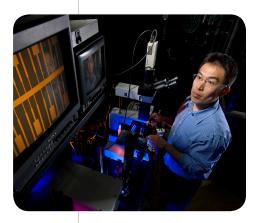
- We engineer to very high standards, not simply to meet a set of requirements, but to assure a mission, which is key to Sandia's value proposition as a federally funded research and development center (FFRDC).
- We deliver for our engineering applications by relying on the fundamental understanding provided by the integration of theory, experimentation, modeling, and analysis. By the same token, we employ our exceptional engineering skills to further scientific discovery by creating unique tools and facilities that help advance fundamental understanding.
- We choose the science we perform based on the engineering we must do in order to assure our missions; hence, there is a compelling reason for the scientific discovery we pursue.
- In the tradition of an FFRDC, Sandia sustains its competencies for the long term. Our enduring missions and stable contracts attract high-caliber staff who spend full careers at Sandia.
- Our scientific knowledge, together with our engineering skills, enables us to anticipate emerging threats to national security.

The different facets of the technical approach used by Sandia's scientists and engineers do not alone define who we are as a laboratory. Sandia's successful mission delivery is achieved by technical staff working hand in hand with our business and operational professionals, a partnership that has become natural, organic to our definition of who we are.

Our solid foundation, described in more detail on Pages 31–35, informs and differentiates our work for our sponsors, both enabling mission delivery and advancing the frontiers of science and engineering.

The Laboratories' framework, along with our programs as embodied in our Program Management Units (PMUs), provides the basis for prioritizing the work of the Laboratories and allows Sandia to realize its intended strategic direction.





Sandia's successful mission delivery is achieved by technical staff working hand in hand with our business and operational professionals...

Sandia's annual strategic planning process, goals, and milestones provide a basis for quarterly performance and internal and external evaluations.

#### FY14-FY18 Strategy

Since FY12, the framework for securing the future of Sandia as a major contributor to the nation's national security has been guided by five major objectives to which we have adhered with consistency and determination. The Laboratory Leadership Team (LLT), described on page 20, believes that those objectives continue to provide the right framework for Sandia, and therefore the current update does not change them in any way. These objectives outline a clear strategic direction to realize both Sandia's vision and mission and establish long-term (~5 years) priorities for resource-allocation decisions. Shorter-term goals (~one to three years) within each objective identify clear achievements that align with each objective's strategic direction. Milestones (~one year) under each goal are established each year to ensure tangible progress in realizing the overarching goal. The next section will describe our strategic objectives and goals in detail.

Sandia's annual strategic planning process, goals, and milestones provide a basis for quarterly performance and internal and external evaluations. Sandia's LLT tracks performance of the goals and milestones through quarterly strategic reviews. In addition, the National Nuclear Security Administration (NNSA) Sandia Field Office monitors performance through the annual Performance Evaluation Plan (PEP).



Sandia National Laboratories, New Mexico



Sandia National Laboratories, California

Strategic Plan FY14-FY18

#### **Strategic Objectives and Goals**

**STRATEGIC OBJECTIVE 1:** Deliver with Excellence on our Commitments to the Unique Nuclear Weapons Mission

Executive Champions: Executive Vice President (EVP) for National Security Programs, and the Nuclear Weapons Leadership Council

Since the late 1940s and reaffirmed in 2010 in the Nuclear Posture Review and other national policy directives, the United States has developed and deployed a nuclear deterrent as a key element of our strategic national security policy. Because the extraordinary power of nuclear arms is critical to our security and devastating in the unlikely event of accidents or unauthorized use, design and stewardship responsibilities are uniquely vested in a government-owned, civilian-controlled nuclear weapons (NW) enterprise. It is Sandia's great honor and privilege, as part of that national enterprise, to own and exercise the responsibility to weaponize the nuclear explosive package and thereby ensure that the nation's nuclear weapons meet the highest standards for safety, security, and effectiveness and that the personnel expertise is maintained.

We are committed to serving the nation by anticipating the needs of an evolving stockpile, innovating new approaches to safety, security and effectiveness, strengthening the scientific underpinnings of our confidence in the stockpile, working in partnership across the enterprise and with the military services to ensure effective life-cycle management, and informing the national debate on critical issues pertaining to nuclear weapons development and use.

In solemn recognition of the power of nuclear weapons, we are committed to the highest standard of excellence in all of our design, development, research, and production activities. We demand superior achievement, seek the best minds to join our team, encourage prudent risk taking in design and innovation, respect the need for work-life balance, and act with integrity and transparency in our relationships with our sponsors.

We are committed to delivering on our obligations in this era of increasing stockpile activity associated with national policy direction for stockpile modernization. Despite national fiscal constraints, both the Administration and Congress have supported four straight years of increases to NW funding. However, these funding increases have not been fully commensurate with the increased work scope and schedule associated with the baseline plan for modernization of both the stockpile and the nuclear production infrastructure. As we work with the leadership across the U.S. NW enterprise to examine affordable excursions to the baseline strategy, we will strive to ensure that the pace and scope of the stockpile modernization work is fiscally responsible and consistent with both the current condition of the existing stockpile and the military performance characteristics required for the future. We are also committed to the definition of a new baseline program that balances modernization needs with our obligations to the existing stockpile and the strategic need to continuously advance the science and engineering capabilities of the enterprise.



- Sandia is uniquely responsible for
- warhead systems engineering and integration
- We have design responsibilities for all nonnuclear components, and production responsibilities for specialty components such as neutron generators and radiation-hardened microelectronics
- This modernization era will require increased focus on cost-effective product delivery, management discipline, and trusted partnerships
- Sandia maintains world leadership in pulsed power and other science and technology areas underpinning our NW mission
- We will apply the tools of stewardship and modern technologies to address stockpile issues
- We will lead the enterprise in the development of innovative alternative strategies for creating a balanced NW program portfolio



In solemn recognition of the power of nuclear weapons, we are committed to the highest standard of excellence in all of our design, development, research, and production activities.

#### **OBJECTIVE 1: GOALS**

**Goal 1: Leadership**—Provide leadership to influence at a national level a unified stockpile vision.

**Goal 2: Relationships**—Enable a strategic PEP by increasing both confidence and credibility with NNSA in our ability to develop and execute to the "Implementation Plan" construct.

**Goal 3: Mission Space**—Solidify Sandia's role as the engineering laboratory of the nuclear weapons enterprise.

**Goal 4: Tech Base Stewardship and Application**—Steward critical nuclear weapons core capabilities, products, pulsed power mission, and production mission to ensure an increasingly robust scientific and engineering understanding for current and future stockpile and broader national security needs.

**Goal 5: Program Management Excellence**—Through superior rigor in cost estimation, project management, and quality, provide outstanding performance in meeting all nuclear weapons deliverables and requirements.

**Goal 6: Shifting the Paradigm**—Identify revolutionary (vs. evolutionary) ways to execute our nuclear weapons mission—bold, game-changing approaches to (a) take care of the stockpile we have, (b) create the stockpile of the future, and (c) develop and sustain the needed capabilities and infrastructure to meet growing expectations for cost effectiveness and agility.

#### **STRATEGIC OBJECTIVE 2:** Amplify our National Security Impact

#### **KEY POINTS**

- Sandia is developing strategies for the eight mission areas that will provide the overarching framework for the future of the Laboratory
- The strategies will guide our discretionary investments to maximize future impact
- We are implementing steps to achieve greater Sandia presence and contribution to the high-level national security dialogue



Executive Champions: EVP for National Security Programs, Chief Technology Officer, and Mission Area Executives

Historically, Sandia has built upon the expertise developed for our primary nuclear weapons mission to address a broad suite of daunting national security problems. Today's national security needs are expansive and dynamic, and include traditional activities such as defense systems, assessments, nuclear proliferation, and energy—and increasingly include new threats such as cyberattack, climate change, terrorism, and economic competitiveness and stability. As we look to the future, we are using the framework of our eight mission areas (MAs) and the Laboratories' foundation to guide our strategic investments and position the Laboratories to address rapidly changing national security problems.

Building on FY13 activities that assembled the framework elements, we are now developing strategies for each of the eight MAs. Linked to the Laboratories' foundation, the MAs will identify the key national security challenges and the capabilities needed to provide robust technical solutions. Additionally, the strategies will guide future Laboratory Directed Research and Development investments, starting with the FY15 proposal process. We are also developing and implementing a structure, built around the MAs, for strategic investments using our program management funds to ensure that new program development is tightly coupled with the MAs and the foundation. Having identified nine Laboratories-level capabilities, we are implementing a capabilities health assessment that will provide additional input into needed strategic investments to support the MA strategies. In order to ensure healthy infrastructure and capabilities for the future, we are formulating business model options that will

entice interagency infrastructure investment in the Laboratories. Finally, we will heighten Sandia's profile in the high-level national security dialogue. We are working with the National Security Interagency on Capability Sustainment, and have initiated a Technology, Policy, and National Security Lecture Series with George Washington University. Through these venues, we seek to contribute to informed thinking on a variety of national security topics.

**OBJECTIVE 2: GOALS** 

**Goal 1:** Mature the mission areas for the next decade, the differentiating Sandia roles in these areas, and the enabling Laboratories-level capabilities that are essential to fulfilling our differentiating roles.

**Goal 2:** Develop an integrated implementation plan for Laboratories' mission areas and the Laboratories-level capabilities.

**Goal 3:** Achieve greater Sandia presence in and contribution to the national dialogue on strategic national security programs and policy issues.

Today's national security needs are expansive and dynamic ... and increasingly include new threats such as cyberattack, climate change, terrorism, and economic competitiveness and stability.

# **STRATEGIC OBJECTIVE 3:** Lead the Complex as a Model 21<sup>st</sup> Century Government-Owned Contractor-Operated National Laboratory

Executive Champions: EVP for Mission Support, and the Mission Support Team

As we move into a future of increasingly complex national challenges and an ever-uncertain international environment, Sandia has defined a strategy that leverages its rich history of advancing U.S. national security through exceptional leadership as a 21<sup>st</sup> century GOCO (government-owned contractor-operated) and preeminent federally funded research and development center (FFRDC).

Sandia will cultivate the following enduring institutional characteristics to enable the Laboratories to flourish as a GOCO/FFRDC in the 21st century:

- Fostering an environment where world-class talent are able to thrive and achieve the highest national impact across Sandia's mission areas
- Stewarding facilities to address long-term, large-scale problems
- Improving operational performance and capability innovation, including speed, responsiveness, and flexibility
- Aligning work systems and learning initiatives with strategic direction
- Enhancing organizational knowledge management to improves process, products, and services

Strategic Objective 3 focuses on three areas: advancing the GOCO/FFRDC model in partnership with NNSA to improve organizational effectiveness, enabling investments and recapitalization while sustaining reasonable costs, and effectively managing and innovating business and technical approaches and deliverables.

Sandia will continue to execute innovative technical and organizational approaches while operating efficiently and effectively. Sandia will inspire the confidence of our national constituents through performance excellence and superior execution in service to the nation, safe and secure management and operation of the facilities, loyalty and commitment to its people, and a culture that embraces quality and continuous improvement.

#### **KEY POINTS**

Sandia will exemplify the 21st century GOCO/FFRDC model through

- Advancing the GOCO/FFRDC model in partnership with the NNSA
- Building business analytic capabilities to enable data-informed decisions
- Defining and simplifying a 21st century integrated management system
- Consolidating data centers, expanding centralized storage, and reinvesting cost savings
- Implementing advanced systems to manage materials through their lifecycle
- Deepening Sandia's quality implementation and optimizing project management
- Enriching and sustaining a robust safety culture by integrating proactive work planning and engineered safety into everyone's daily work



#### **OBJECTIVE 3: GOALS**

**Goal 1:** Demonstrate FFRDC leadership in governance reform that leads to improved effectiveness and stewardship.

**Goal 2:** Enable recapitalization and/or investments while sustaining reasonable costs for the customer.

**Goal 3:** Effectively manage and innovate business and technical approaches and deliverables.

#### **STRATEGIC OBJECTIVE 4:** Excel in the Practice of Engineering

Executive Champions: VP for Science & Technology, and NW Chief Engineer

Sandia National Laboratories has a long and distinguished record of providing innovative and unique technical products and services that enable our customers to anticipate and counter threats to U.S. national security. These engineered products and services draw deeply upon and

# Sandia will excel in the practice of engineering by delivering innovative products and services through a

 Aggressively develops and exploits advances in science and technology

**KEY POINTS** 

- Draws upon a deep understanding of engineering and scientific principles
- Engages the external community
- Achieves assured quality

disciplined approach that

are enabled by advancements in science and technology, and the often unique capabilities that result from such advancements. We intend to be a standard-bearer for the practice of engineering with excellence. First, we will provide our customers with innovative engineered products and services enabled by the aggressive exploitation of advances in science and technology, and built upon a deep understanding of engineering and scientific principles. These products and services are the ultimate manifestation of our value to the nation. Second, we will strengthen our management and execution of our engineering programs by adopting or developing techniques and practices that ensure quality with a disciplined approach for the engineering of products and services. We will increase external and internal confidence in our ability to deliver consistently on our commitments and advance the state of the art in the practice of engineering.



#### **OBJECTIVE 4: GOALS**

**Goal 1:** Advance capabilities and insertion of research innovations to impact mission. Our current focus is to mature Sandia research challenges and advancing the mission impact for high-performance computing and simulation.

**Goal 2:** Enhance our engineering environment. Our current focus is to deploy our common engineering environment, research quality standards, and maturing trust engineering.

**Goal 3:** Enhance our competencies through external engagement. Our current focus is to improve Sandia's research environment, enhancing external collaborations, and increasing external recognition.

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# **STRATEGIC OBJECTIVE 5:** Commit to a Learning, Inclusive, and Engaging Environment for our People

Executive Champions: EVP for Mission Support, and a Mission Technologies Division VP

Sandia will attract, retain, and engage world-class talent to execute our national security mission. The Laboratories will be nationally recognized for innovation, continuous learning, inclusion, and careers in service to the nation. Our people will feel valued, trusted, and engaged at work, and will have access to the best facilities, technologies, and resources to achieve mission success. The mission will be accomplished in an environment that promotes personal growth, individual health, and work-life integration.

Our strategy includes increasing the resilience of our workforce to anticipate the unexpected while exploring new frontiers to protect our nation and allies. Our wellness and health programs will address the whole person and equip our employees to better manage stress and life's challenges, enabling them to focus and deliver their best in the nation's interest. We will leverage contemporary, innovative solutions for learning and development to ensure workforce readiness.

#### **OBJECTIVE 5: GOALS**

- **Goal 1:** Attract, develop, and retain talent for mission success.
- **Goal 2:** Emphasize diversity and inclusion to drive innovation.
- **Goal 3:** Promote a healthy, energized workforce.

#### **KEY POINTS**

- We will be mission focused and maintain a work environment rich in learning, with career opportunities that enable people to reach their full potential
- We will engage employees in the mission in order to offer innovative solutions for the nation's most challenging problems
- We are committed to personal growth, health, and work-life integration to ensure a robust and diverse talent pipeline
- We value diversity and inclusion and will continue to promote a diverse, inclusive work environment at individual, team, and enterprise levels to optimize performance









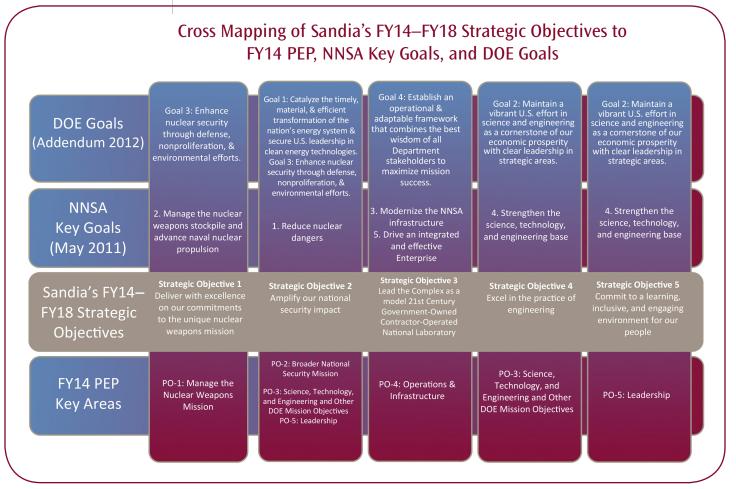




#### **Alignment with DOE and NNSA Goals**

Sandia's strategic planning process ensures integration and alignment with the Department of Energy (DOE) and National Nuclear Security Administration (NNSA) Strategic Plans and Sandia's Strategic Performance Evaluation Plan (PEP) performance objectives. Sandia's FY14 PEP promotes a strategic governance and oversight framework based on prudent management of risk, accountability, transparency, and renewed trust. Table 1 illustrates the alignment and consistency of each of the five Sandia FY14—FY18 Strategic Objectives with the DOE Goals from the Department of Energy Strategic Plan¹ (2012 Addendum) and with the NNSA Key Goals from the National Nuclear Security Administration Strategic Plan.² It also shows the alignment and consistency of the FY14 PEP Key Areas to the Sandia FY14—FY18 Strategic Objectives.

Table 1. Sandia's Alignment with DOE and NNSA Goals



<sup>1</sup>U.S. Department of Energy Strategic Plan, DOE/CF-0067, May 2011. Available at http://energy.gov/sites/prod/files/edg/news/documents/DOE\_StrategicPlan.pdf

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<sup>&</sup>lt;sup>2</sup> The National Nuclear Security Administration Strategic Plan, DOE/NA-0017. http://www.nnsa.energy.gov/sites/default/files/nnsa/inlinefiles/2011\_NNSA\_Strat\_Plan.pdf

#### **Structure**

#### **Executive Leadership**

Sandia's structure strengthens integration across our national security missions; integrates mission delivery; streamlines leadership decision making; and clarifies executive leadership roles, responsibilities, authorities, and accountabilities (see Figure 3 for our reporting structure).

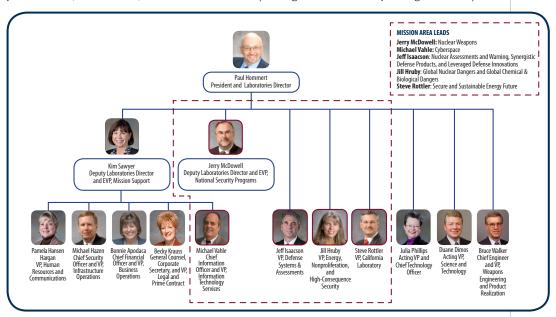


Figure 3. Executive leadership structure (February 2014)

In April 2013, several executives were assigned additional responsibilities to shepherd the progress of the new mission areas (MAs). Jerry McDowell leads the Nuclear Weapons MA; Jeff Isaacson leads the Nuclear Assessments and Warning, Synergistic Defense Products, and Leveraged Defense Innovations MAs; Jill Hruby leads the Global Nuclear Dangers and Global Chemical and Biological Dangers MAs; Steve Rottler leads the Secure and Sustainable Energy Future MA; and Michael Vahle leads the Cyberspace MA.

All executive vice presidents (EVPs) and vice presidents (VPs) are members of the Laboratories' Leadership Team (LLT), which is chaired by the president and Laboratories director. LLT is responsible for integrated strategic leadership, assured mission performance, shared excellence and learning, and communication. LLT provides a forum for Sandia's executive team to assess its performance and formulate plans to improve the management of the Laboratories, plan the Laboratories' future, and discuss issues of corporate importance. Indeed, all institutional matters of importance are discussed and finalized by LLT members, who spend considerable effort in ensuring that Sandia is appropriately positioned to bring technical solutions to a broad range of national security challenges.

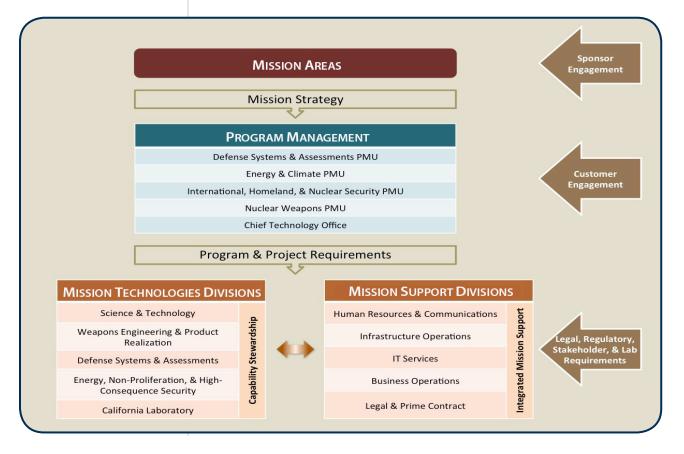
The Mission Support Team (MST), a subset of LLT, is chaired by the Mission Support EVP and is composed of five Mission Support division VPs; the Corporate Governance and Mission Support director; and the Independent Audit, Ethics, and Business Conduct director. The team determines the strategy for capabilities supporting mission execution, anticipates mission execution needs, and together with the Mission Technologies divisions, develops integrated solutions

LLT provides a forum for Sandia's executive team to assess its performance and formulate plans to improve the management of the Laboratories... ... MST develops integrated solutions for operational efficiency and effectiveness. for operational efficiency and effectiveness. MST owns the Laboratories' policy areas, each of which focuses on an operational risk and translates outside requirements into internal rules and guidelines subsequently deployed throughout the Laboratories. It also conducts management reviews of its policy areas and divisions to ensure progress in attaining strategic objectives, goals, and milestones. Finally, MST defines an annual budget and investment strategy, aligned with mission priorities, for Mission Support activities.

#### **Organizational Functions**

Sandia's organizational functions, collectively, will enable the execution of our strategy (depicted in Figure 4). Sandia's mission areas, introduced on Page 11, engage with sponsors and identify different national security challenges for which Sandia may contribute solutions and provide a prioritized focus for the Laboratories' Program Management Units (PMUs) and Chief Technology Office (CTO). The CTO establishes our research direction and stewards investments to continue to advance science and technology at the Laboratories. PMUs engage with customers to negotiate agreements and commitments and allocate work and funding to the divisions in order to accomplish Sandia's mission. Mission Technologies divisions have operational responsibilities to perform work negotiated with PMUs and steward their capabilities and workforce in alignment with program requirements. Mission Support divisions provide the infrastructure, tools, and expertise needed to deliver integrated support services to the Laboratories while ensuring the proper mechanisms are in place to comply with legal, regulatory, stakeholder, and Laboratory requirements. All divisions have the responsibility to operate effectively, efficiently, and in compliance with regulations and constraints while improving quality and value to the customer. Pages 22–24 describe the PMUs, CTO, and divisions in more detail.

Figure 4. Sandia's organizational functions



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#### **Program Management Units**

Sandia's four agile Program Management Units (PMUs) develop operational plans aligned with MA strategies, secure work and funding from external and/or internal customers, and distribute tasks and funding to the twelve divisions. PMUs adapt to changes stemming from the dynamic environment and maintain a steady focus to deliver on their commitments. The PMUs are described in Table 2.

**Table 2. Program Management Units** 

Defense Systems and Assessments (DSA)	The DSA PMU fosters invention, innovation, maturation, and demonstration of technologies to enable future force capabilities and exploit opportunities to transition technology-enabled capabilities to the current force. Science and technology must serve the needs of the warfighter and provide our armed forces with new and improved capabilities to perform their missions against any current and/or future threats. Our primary mission is to deliver advanced science and technology solutions to deter, detect, track, defeat, and defend against threats to our national security. We analyze the vulnerabilities of our adversaries and develop innovative systems, sensors, and technologies for the defense and national security community.
Energy and Climate (EC)	The EC PMU provides knowledge and solutions for the nation's most challenging energy and climate problems. The PMU leverages Sandia's relationship with the state of California and its energy challenges. EC capitalizes on the cyber competencies and synergies within these two areas to create unique solutions for the nation. EC champions the Energy Security corporate Strategic Thrust and supports the Cyber and Nuclear Security corporate Strategic Thrusts.
International, Homeland, and Nuclear Security (IHNS)	The IHNS PMU's mission responsibilities include advancing weapons of mass destruction (WMD) nonproliferation goals; securing and safeguarding WMD materials and facilities; countering, responding to, and recovering from WMD use by terrorists or others; ensuring the resilience of critical U.S. physical and cyber infrastructures; and reducing the risk to our nation from significant national incidents. Working for many domestic and international sponsors, IHNS applies a wide range of capabilities to address key risks across dynamic and complex interdependent systems.
Nuclear Weapons (NW)	The NW PMU has full life cycle responsibility for the stewardship of the nation's nuclear weapons stockpile in partnership with other laboratories and production facilities in the nuclear weapons enterprise. This requires a balanced approach to the three program imperatives to: (1) steward the current nuclear stockpile that we have today, (2) modernize the stockpile into the future through life extension programs and alterations, and (3) advance the underpinning foundational aspects of our science and engineering capabilities, our business and management tools, the staff, and our facilities and infrastructure.

#### **Divisions**

As detailed in Table 3, Sandia has twelve line-execution divisions that are managed by our vice presidents. The divisions have operational responsibilities for integrated mission success and perform work negotiated with PMUs.

#### **Table 3. Line Execution Divisions**

#### **Mission Technologies Divisions**

00001 and 00002— Executive Support Division	The Executive Support Division includes the Office of the Laboratories Director, which sets the high-level vision and strategic direction for the Laboratories and is the primary interface with the Sandia Corporation Board of Directors, executive leadership of key customer agencies, and executive leadership of Department of Energy (DOE)/ National Nuclear Security Administration (NNSA). Key functions include: strategic planning, executive councils, government relations, and protocol.
	The Executive Support Division also includes the Office of the Deputy Laboratories Director for National Security Programs, which enables decisions, develops processes, and provides integration support on behalf of Sandia's National Security Programs. Key functions include: NW planning, operations and integration; surety assessment, engineering and analysis; nuclear enterprise assurance, field intelligence element operations; and counterintelligence.
1000—Science and Technology	The Science and Technology Division provides the nation with cutting edge research and development that enables the missions of the Laboratories and advances the state of science and technology in  Integrating theory, experimentation, modeling, and analysis  Inventing, designing and producing nanodevices and trusted, radiation-hardened microsystems  Environmental testing and qualification, including operations of high hazard facilities  Creating and using high-performing computing environments  Providing fundamental understanding of materials  We translate research into products through our advanced manufacturing capability and component engineering role. Our people are leaders in science, technology, and in their professional communities.

#### Table 3. Line Execution Divisions (continued)

### **Mission Technologies Divisions** (continued)

2000—Weapons Engineering and Product Realization	The Weapons Engineering and Product Realization Division leads the Laboratories' efforts in nuclear weapons engineering and production activities. The division also provides advanced technologies and systems for missile defense, nonproliferation of weapons of mass destruction, homeland security, energy security, and critical infrastructure assurance. Our strategic focus and influence enable us to achieve engineering mastery, deliver what matters to the nation, and build stakeholder trust. Our key capabilities enable us to achieve our strategic focus:  • Nuclear weapons systems engineering, integration, and lifecycle support  • Component and subsystem engineering design, integration, production, and lifecycle management  • Stockpile evaluation, training, and response
5000—Defense Systems and Assessments	<ul> <li>The Defense Systems and Assessments Division provides technological solutions for defense and national security needs. Division 5000 applies its expertise in engineering and integrating advanced science and technology into pathfinder systems to</li> <li>Develop, design, and deliver electronic and radio frequency systems for the purposes of arming, fuzing, surveillance, tracking, locating, navigation, control, and secure communication</li> <li>Create optical, seismic, acoustic, chemical, biological, radiological, nuclear, and explosive sensing technologies, and design those into detection, monitoring, and surveillance systems that operate in the various domains of ground, air, sea, and space</li> <li>Design, deliver, and operate satellite, atmospheric, and ground systems for high fidelity national security missions</li> <li>Execute proliferation and threat assessments for WMD and other high consequence national security needs</li> <li>Create and deliver technologies and systems to discern, defeat, and attribute cyber-attacks against critical national information, communication, and security networks</li> <li>Develop and deploy technologies and techniques to execute forensic analysis of and reverse engineer devices, systems, and events impacting national security</li> <li>Design, analyze, develop, test, and evaluate prototypes of advanced offensive and defensive military systems</li> </ul>
6000—Energy, Non- Proliferation, and High- Consequence Security	The Energy, Non-Proliferation, and High Consequence Security Division develops technologies and systems solutions for the nation's energy, non-proliferation, and high-consequence security challenges. Our solutions are innovative, cost-effective, and sustainable, and build from a deep understanding of science and technology. Our approach includes the use of sophisticated assessment and modeling that consider interdependencies, dynamic threats, and adaptive behavior.  We anticipate, develop, and nurture capabilities to address current and future national security needs in four capability portfolio areas:  • Global security of WMDs  • Energy systems and the nuclear fuel cycle  • Intersection between the earth and engineered environments  • Complex and intelligent systems  We also lead capabilities key to the Laboratories' overall national security mission; those capabilities include  • Geosciences  • Complex systems modeling  • Robotics  We work cooperatively with customers and sponsors, nationally and globally. Our success depends on partnerships—both inside and outside the Laboratories.
7000—Chief Technology Office	The Chief Technology Office (CTO) leads development and implementation of Sandia's research strategy through collaborative decision-making. The responsibilities of the CTO fall into four main categories:  • Science and technology strategy and governance  • Capability management and assessment  • Laboratory Directed Research and Development program strategy and management  • Partnerships strategy and management
8000—California Laboratory	The California Laboratory Division, based in Livermore, California, supports the nation with a premier science and engineering laboratory for national security and technology innovation. The California Laboratory Division performs research and development to meet national needs in multiple mission areas with exceptional expertise in  • Systems engineering and analysis for nuclear weapons  • Defense against chemical, biological, radiological, and nuclear dangers  • Defense against cyber threats  • Transportation, fuels, and engines and their impacts  Sandia, California, is a fully integrated site and home to the Livermore Valley Open Campus, a unique collaborative environment that provides a gateway for Sandia to increase engagement with the national and international industrial and academic communities.

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Table 3. Line Execution Divisions (continued)

### **Mission Support Divisions**

00003—Executive Support Division	The Executive Support Division also includes the Office of the Deputy Laboratories Director for Mission Support, which enables decisions, develops processes, and provides integration support on behalf of Sandia's Mission Support Divisions. Key functions include independent audit, corporate ombuds, ethics and business conduct, corporate governance, and operational innovation.
3000—Human Resources and Communications	The Human Resources and Communications Division develops and delivers human resources strategies, products, tools, services, and solutions to attract, retain, and inspire the workforce needed for Sandia's current and future business success. The division also conveys and promotes Sandia's accomplishments, capabilities, and image to customers and constituents.
4000—CSO and Infrastructure Operations	The Chief Security Officer and Infrastructure Operations Division develops and provides strategies, tools, services, and infrastructure operational management in support of Sandia's current and future needs in the areas of environment, safety and health; waste management; safeguards and security; facilities development, maintenance and operations; emergency management; international engagement; and serves as the interface with regulatory and external oversight agencies related to these areas.
9000—CIO and IT Services	The Chief Information Officer and Information Technology Services Division provides Sandia's information management infrastructure, which includes corporate information systems and applications, network and telecommunications structure, science and engineering information systems, and cyber security operations. Our strategic focus enables us to be an innovative leader in information management. Our key capabilities that permit us to achieve this focus are the following:
	Design and provide modeling and simulation services and software development to support large complex engineering and science problems
	<ul> <li>Create and deliver cyber security solutions which enable mission work to be delivered</li> <li>Translate business processes into integrated IT services and apply innovative information analysis techniques</li> </ul>
	to enable informed decisions and actions and thus to improve the Labs' operating effectiveness and efficiency
	Design and operate efficient and secure information technology infrastructure and application solutions to improve workforce engagement and increase productivity
	<ul> <li>Maximize leverage of our core capabilities to the benefit of solving national security challenges. In turn, leverage the resulting advancements for the benefit of solving Sandia's internal operational challenges</li> </ul>
10000—CFO and Business Operations	The Chief Financial Officer and Business Operations Division provides financial, accounting, supply chain, materials management, logistics, contract management, interagency work, and policy management services for Sandia. The division also facilitates cost estimating, budgeting, and business planning activities across Sandia by positioning business staff who are either within or matrixed to various divisions and PMUs.
11000—Legal and Prime Contract	The Legal and Prime Contract Division provides counsel and legal services in support of Sandia's mission. Legal's services include general corporate law; employment and labor relations; taxes and benefits; environment, safety, and health; procurement; intellectual property; patents and technology transfer. Additionally, the division provides prime contract management, export control management, and activities supporting the Sandia Corporation Board of Directors.

# STRATEGIC PLAN FY14-FY18

# PART II

Framework Components
Our mission areas, resources, and capabilities



#### **Mission Areas**

This section is devoted to describing more closely Sandia's eight mission areas (MAs), which provide strategy for the Laboratories' program management units (PMUs) and foundation. The MAs also communicate the priority ascribed to different national security challenges for which Sandia may contribute solutions by focusing its investments in capabilities, people, infrastructure, and tools. The MAs allow us to bring new clarity to what we have long held to be essential, namely, that the long-term health of capabilities necessary to execute the nuclear weapons (NW) mission requires broader national security mission work.

The mission areas allow us to bring new clarity to what we have long held to be essential...

#### **Nuclear Weapons**

The United States is embarking on a new era in NW policy, the modernization of the aging nuclear arsenal and infrastructure. In the context of a complex global and domestic landscape, modernization requires innovative and cost-effective approaches and solutions. In its role as the country's NW systems engineering laboratory, Sandia weaponizes the nuclear explosives package of nuclear weapons to create a militarily effective and logistically sustainable U.S. nuclear deterrent. Leveraging its pulsed power and high energy density physics expertise, Sandia also plays a critical role in understanding the science that underlies nuclear weapons and their vulnerability to radiation. In partnership with the other National Nuclear Security Administration (NNSA) laboratories and production agencies, Sandia ensures that the nation's nuclear weapons meet the highest standards for safety, security, and effectiveness and that the personnel expertise is maintained. Nuclear weapons must always work when commanded and authorized by the president of the United States, and they must never detonate under any other circumstance. Nuclear weapons must survive extremely complex and often harsh environments. They could remain dormant for up to 30 years, yet must be immediately available when the nation is at high alert or readiness levels. Sandia has full life-cycle responsibilities for all nuclear weapons in the U.S. stockpile. These responsibilities range from early exploratory concepts through design, qualification, deployment, ongoing maintenance, and evaluation to, ultimately, dismantlement and disposition. This highly complex technical challenge requires an array of engineering and scientific disciplines underpinned by deep unique capabilities, including microsystems, major environmental tests, pulsed power, materials science, and advanced computing.

... Sandia ensures that the nation's nuclear weapons meet the highest standards for safety, security, and effectiveness and that the personnel expertise is maintained.

To meet these challenges, the nuclear weapons mission area (NWMA) develops forward thinking, paradigm shifting strategies and associated strategic plans to provide guidance to the NW PMU, as well as to the new core MAs: Global Nuclear Dangers, Nuclear Assessments and Warning, Cyberspace, and Synergistic Defense Products. The NWMA works in partnership with these four MAs to ensure the mutual understanding and support of each other's mission needs and capabilities. In developing these strategies and plans, the NWMA will balance the requirements of (1) stewarding the current nuclear stockpile, (2) modernizing the stockpile into the future through life extension programs and alterations, and (3) advancing the foundational aspects of our science and engineering capabilities,

advancing the foundational aspects of our science and engineering capabilities, business and management tools, the staff, and facilities and infrastructure. The NWMA will also lead the NW enterprise in the development of revolutionary (rather than evolutionary) ways to execute our NW mission – bold, game-changing strategies for creating an NW program portfolio using these same three balancing criteria. To execute stockpile modernization, the



NWMA challenges organizations to implement a fiscally responsible pace and scope consistent with current conditions of the existing stockpile and with future performance characteristics as required by the military.

Further, the NWMA, in partnership with the NW PMU, will engage with the NNSA, the NNSA laboratories and production agencies, the Department of Defense (DoD), and other leaders across the country's NW enterprise to ensure that the near-, mid-, and long-term challenges facing the national security enterprise are mutually understood.

#### **Reduce Global Nuclear Dangers**

Two global nuclear security summits have unanimously agreed nuclear weapons and nuclear and radiological materials in the hands of terrorists remain the most dangerous threat to global security. And as we have seen, a radioactive release at a nuclear power plant (for example, the Fukushima accident) has devastating, long-lasting consequences for human life and the environment. Sandia's Reducing Global Nuclear Dangers MA is directly connected to the NWMA in two ways. First, it requires understanding of nuclear weapon incidents and of the design, production, transportation, and security of nuclear weapons. Second, it informs nuclear weapons planning through an understanding of arms control, treaty requirements, and the relationship between deterrence and nonproliferation.

Reducing Global Nuclear Dangers involves addressing the risks and improving the situational awareness of emerging risks posed by (1) nuclear weapons—whether they are controlled by the United States or another nuclear weapon state, or whether they are in the hands of rogue states and nonstate actors and terrorists, (2) the misuse of nuclear and radiological materials, nuclear weapons knowledge, and/or nuclear weapons components, and (3) a large-scale radioactive release from a nuclear power plant.

Reducing Global Nuclear Dangers is an MA with a broad scope, developing technologies and solutions for both domestic and international applications. For example, it provides (1) security systems for fixed DoD sites, associated weapons and materials, and transportation systems such as the SafeGuards Transporter; (2) technologies for monitoring and verifying arms control treaties, such as radiation detection systems for inspectors, and technical support to arms control negotiations; (3) technology and systems for remote monitoring proliferation activities; (4) cooperative threat reduction (best known as CTR) technologies and activities with international partners, such as Track II, involving states with nuclear materials at risk; (5) technologies for securing all elements of the nuclear fuel cycle, as well as expertise and technology that could be used for nuclear proliferation

and terrorism; (6) technologies and systems to prevent terrorists from obtaining or using nuclear or radiological weapons; (7) technologies and support for effectively responding to an event; and (8) technologies and systems associated with situational awareness, that is, creating and using information to prevent or mitigate risks.

Reducing Global Nuclear
Dangers is a mission area
with a broad scope,
developing technologies
and solutions for both
domestic and international
applications.



#### **Provide Nuclear Assessments and Warning**

In service to NNSA's nuclear nonproliferation mission, Sandia has long provided sensing systems and analysis to detect nuclear detonations and understand nuclear threats against the United States and its allies. These threats involve extremely difficult technical challenges associated with denied access and active deception by non-cooperative nation-states, the emergence of non-state actors, the need to perceive threats early in their life-cycle and in their actual employment, and the subtle nature of threat signatures. The nation relies on Sandia not only to understand the threats, but also to counter the threats with analysis and technology. Three key elements

of this mission area are the following: (1) developing technologies and systems to detect, evaluate, and disseminate information on nuclear detonations to decision-makers in a timely manner; (2) providing analyses and assessments to help the United States counter existential threats and avoid strategic technology surprise; and (3) developing pathfinding technologies and systems to track items, events, people, communications, and transactions across the full spectrum of human interactions. Among our key products are nuclear threat assessments, global burst detection payloads, nuclear detection processing systems, proliferation assessment sensors, and technology surprise assessments.

The nation relies on
Sandia not only to
understand the threats,
but also to counter the
threats with analysis and
technology.



#### **Defend and Dominate in Cyberspace**

The United States is becoming ever more aware of its dependence on and associated vulnerability in networked information systems used for national defense as well as for all other aspects of daily life. Computers and networks, both wired and wireless, produce the fabric for data movement. They have become an essential technology for economic competitiveness and for the sixteen sectors of U.S. critical infrastructure. Moreover, commercial

networks form the backbone of much of the U.S. military and intelligence networks. Unfortunately, information technology (IT) is becoming more vulnerable. Hence, the United States cannot be confident that its critical IT systems will work under attack from a sophisticated and well-resourced opponent that uses cyber capabilities in combination with its entire military and intelligence capabilities (what is known as a "full spectrum" adversary). Sandia's key products in this area include (1) tools and techniques to improve cyber defense in depth, networks, surety of data and communication, and trust added to systems built from untrusted components; (2) technologies and techniques to determine vulnerabilities and associated defenses, detections, and remediations that keep pace with commercial advancements in communications, microelectronics,

computational systems (static and mobile), and software; and (3) technologies and techniques for the United States to assess situational awareness, to assure resilient command and control of strategic and tactical systems, and support the DoD in the evolution of networks becoming a warfare platform.



Unfortunately, information technology (IT) is becoming more vulnerable.



# Maintain U.S. Defense Technological Superiority through Synergistic Defense Products

This mission area focuses on a set of national security products to provide technological superiority to critical national security needs. Highly synergistic with the products of Sandia's core NW mission, these defense products actively draw from and feed back into the NW program, and they support a variety of Defense, Intelligence, and Homeland Security missions such as (1) combating terrorism at home and abroad, (2) dominating across the full spectrum of warfare, and (3) enabling Special Operations.



In the area of radars, for example, Sandia has led the development of real-time processing and high performance technologies for synthetic aperture radar (SAR). Advancements in these technologies were made possible by our extensive radar design and development work for nuclear weapon fuzing, to the benefit of the DoD and other government agencies. The extensive SAR work has sharpened our radar design competencies and kept Sandia aligned with advances in radar technology, such as radio-frequency integrated circuits. We are now applying these modern technologies to the design of the

replacement radar for the B61 life extension programs, the W88 ALT 370, and the Mk21 Fuze Replacement with a high degree of commonality, which leads to cost savings.

Our key products include (1) radars and radio-frequency systems; (2) hypersonic strike systems; (3) ballistic missile defense systems and technologies (reentry vehicle related); (3) directed energy systems; (4) explosive devices, detection systems, and characterization; (5) electronic subsystems; and (6) tagging, tracking, and locating systems.

#### **Reduce Global Chemical and Biological Dangers**



In light of the rapid development and globalization of advanced chemical and biological (CB) technologies, threats to U.S. national security are dramatically changing. CB agents in the possession of hostile states and terrorists now represent one of the greatest security challenges facing the United States. The biological threat includes naturally-emerging, traditional, and engineered agents. The global stockpiling and use of toxic chemical agents present a similarly complex risk environment, ranging from traditional agents developed for chemical warfare to new classes of hazardous chemicals.

Sandia is responding to the complex challenges of this threat environment by developing sophisticated prevention, preparation, and response strategies and technical solutions based in sound analysis, innovative solutions, and state-of-the art science and engineering. To that end, Sandia (1) works internationally to reduce the risk of biological or toxic chemical agents falling into the hands of our adversaries; (2) designs CB warning and response architectures for civilian protection and plays a central role in their deployment, operation, and response; (3) develops next-generation CB detection systems—including devices that can monitor a person's exposure to a toxin or pathogen; and (4) leads national efforts in CB event response and recovery by providing tools and expertise in event characterization, crisis management, decontamination, and restoration of capability and infrastructure.

#### **Ensure a Secure and Sustainable Energy Future**

The prosperity of the United States is tightly coupled with the security and sustainability of its energy infrastructure and supply. Shifting geopolitical dynamics create a broad spectrum of challenges that could threaten the U.S. energy future. Immediate and long-term threats affecting energy stability—such as the depletion of fossil fuels which is compounded by carbon emission concerns—add layers of complexity to ensuring a secure and sustainable energy future. Through a diverse, sustainable energy research, development, and demonstration portfolio, Sandia has developed an expansive experience base and a suite of capabilities that address energy sustainability. Sponsored program-level efforts have resulted in significant progress in (1) renewable and fossil energy, including concentrating solar and photovoltaics, wind, hydrokinetics, geothermal, biomass, and natural gas drilling; (2) electric grid integration and resiliency and the integration of stored renewable energy; (3) safety and security of nuclear power systems and nuclear waste management; (4) cleaner and more efficient vehicle technologies; and (5) energy efficiency in solid-state lighting and innovative semiconductors.



#### Maintain U.S. Defense Technological Superiority through Leveraged Defense Innovations

This mission area focuses on a set of national security products that provide technological superiority to critical national security needs. These products are leveraged from capabilities necessary to perform Sandia's core NW mission. In aggregate, they support a broad set of Defense, Intelligence, and Homeland Security missions such as (1) high-performance non-nuclear sensing, (2) anticipating and countering novel asymmetric threats, (3) providing sensor access to difficult areas, (4) key enabling technologies for warfare dominance and response, and (5) applied data intelligence and decision support systems.

Rocket-based launch systems are only one example of key leveraged products. This capability is made possible by our decades of experience building sounding rockets to record data for atmospheric nuclear tests at the Kauai Test Facility. Today, this capability supports rapid prototyping and launching of targets for ballistic missile defense (BMD) testing, as well as emerging needs in support of responsive space and other BMD missions. Another example is satellite system development, including satellite precision mechanisms and stronglinks, digital and analog electronics, environmental modeling/simulation/testing, navigation and control, and systems engineering. These same capabilities are crucial to the success of the NW mission, which has benefitted significantly from the skills and knowledge maintained through satellite work. Other key products in this area include (1) ballistic missile defense systems and technologies (non-RV related), (2) sensors for tactical and strategic missions, (3) launchers that enable responsive space access, (4) physical security systems, (5) small satellite pathfinders (see definition of pathfinders on Page 35 of this document), (6) hard target defeat systems, (7) systems for space situational awareness, and (8) systems analytics and technical assessments.



#### Laboratories' Foundation

We have envisioned a model whereby the Laboratories' foundation—the very base that gives our institution its energy, meaning, and uniqueness—is composed of our vital resources in people, facilities and tools, and research. In turn, these resources generate our distinguishing capabilities, which are central to our model because they enable mission delivery. In keeping with our vision to be the nation's premier science and engineering laboratory for national security and technology innovation, we recruit the best and the brightest, equip them with world-class facilities and tools, and build upon long-standing research base by advancing the

frontiers of science and engineering, giving rise to unique capabilities that differentiate Sandia's ability to deliver its mission.

**People** — Sandia takes pride in its ability to attract and retain the best and the brightest talent to tackle our most pressing national security challenges. At Sandia, highly educated and highly motivated scientists and engineers pursue science and technology research and development, pushing the frontiers of knowledge in the quest for solutions to national and global security challenges. Side by side with them work our business and operations professionals, who use modern practices to support our missions and drive continuous improvement. Sandia fosters a diverse and inclusive environment, values talented individuals from all backgrounds, and promotes multidisciplinary collaborative teamwork in order to provide exceptional service to the nation. Each year, Sandians are recognized for everything from fundamental advances in scientific understanding to developing breakthrough technologies with commercial applications of global importance.



We bring the capabilities to bear on research challenges. . .



**Research** — Sandia has a deep discipline-based approach to research in areas critical to the work of the Laboratories. This research base informs and differentiates our work for our sponsors, both enabling mission delivery now and in the future and advancing the frontiers of science and engineering.

Certain research areas are key to the success of Sandia's national security missions. Internally known as "research foundations," these areas—underpin Sandia's innovations at the interface of science and technology. In addition, research foundations represent technical areas of excellence in which Sandia has a proven track record of offering unique capabilities and leadership in the scientific and engineering community. Finally, research foundations have a strategic orientation; there is sufficient breadth to adapt and evolve research activities to meet long-term demands and challenges.

We bring the capabilities to bear on research challenges—large-scale, focused R&D efforts that bring together multiple research disciplines and capabilities to address a significant technical problem in a manner that both creates transformational opportunities in national security and advances the frontiers of knowledge. Our most mature current research challenges are the following: Beyond Moore Computing, Data Science, Cyber Resiliency, Trusted Systems and Communications, First to High-Yield Fusion, Detection at the Limit, and Engineering of Materials Reliability, Resiliency in Complex Systems, Science and Engineering of Quantum Information Systems, and Revolutionary Approaches to the Stockpile. Research challenges feed directly into

the Laboratories' mission areas, addressing present, well-described challenges and/or nascent issues that are as yet incompletely articulated and understood. Disciplined-based research foundations include bioscience, computing and information science, engineering science, geoscience, materials science, nanodevices and microsystems, and radiation effects and high energy density science.

Facilities and Tools — Sandia's principal sites are in Albuquerque, New Mexico, and Livermore, California, although we have other facilities in Carlsbad, New Mexico; Tonopah, Nevada; and on the island of Kauai, Hawaii. All our sites are equipped with a distinct set of research facilities and tools to foster collaboration and innovation. Many of Sandia's unique research centers are available for use by U.S. industry, universities, academia, other laboratories, state and local governments, and the scientific community in general. The primary function of our facilities and tools is to satisfy programmatic needs, while remaining accessible to outside users. A few examples of our facilities and tools



include the following: major environmental test facilities, Microsystems and Engineering Science Applications (MESA), Explosive Components Facility, Weapons Evaluation Test Laboratory (WETL), Pulsed-Power Facility, Center for Integrated Nanotechnologies (CINT), Ion Beam Laboratory, and high-performance computing.

#### **Capabilities**

Sandia's nine key capabilities, detailed below, amplify our ability to achieve our missions and enable Sandia's enduring national impact. These capabilities, stewarded by the divisions, represent the essence of Sandia's technical competencies.

#### High-reliability engineering

Sandia designs and develops specialized, highly integrated systems for critical national security applications. These systems require exceptionally high reliability in a range of extreme operating environments, including accident conditions and hostile attacks. Through high-reliability engineering, intricately designed and trusted components are being integrated with a solid material science and computer simulation scientific basis for characterizing performance across the required environments and extended life cycles. This capability is enabled by state-of-the-art computational simulation, rapid development and prototyping laboratories, and physical simulation capabilities for the full suite of electrical, mechanical, thermal, and radiation environments.

**Key examples:** Systems for applications ranging from nuclear weapons and physical security to space-based platforms.





#### **Sensors and sensing systems**

Sandia advances and applies the science of signal phenomenology and processing, optics, and electronics to create high-resolution sensors and sensing systems that can detect, discriminate, identify, and track objects and activities in ground, air, sea, and space in real time.

**Key examples:** Electronic and radio frequency systems for surveillance, tracking, locating, navigation, control and secure communication; optical, seismic, acoustic, chemical, biological, radiological, nuclear, and explosive sensing technologies for detection, monitoring, and surveillance systems; and satellite, atmospheric, and ground systems for high-fidelity national security missions.

#### Cyber technology

Sandia develops cyber technology from fundamental research in information sciences to delivery of integrated systems in order to discern, defeat, and attribute cyber attacks against nuclear weapons, communication and security networks, and other critical infrastructures.



**Key examples:** Cyber security expertise for the NW enterprise; the intelligence, defense, and homeland security communities; international security programs; partnering with other government agencies, and defending our own site against sophisticated, persistent, and well-resourced adversaries; core cyber competencies—from a trusted foundry to penetration testing of complex systems, use of high performance computing for network emulation and data analytics, and applying cognitive science to enable the expedited development of cyber defenders; technologies, techniques, and tools for cyber defense in depth, resiliency of networks, surety of data and communication, and adding trust to systems built from untrusted components.

#### **Reverse engineering**

Sandia reverse engineers materials, devices, systems, and events, and it performs associated forensic analysis. Reverse engineering is the product of a unique mindset, coupled with a threat-informed, vulnerability assessment methodology stemming from decades of experience in evaluating mission critical systems at the highest standards. Developing a comprehensive understanding of systems and technologies—hardware and software—through analysis of their structure, function, and operation enables Sandia to deliver solutions that identify and mitigate both physical and cyber risks.

**Key examples:** Research and development capabilities in microsystems analysis, design and production, testing, and modeling and simulation for protecting systems critical to national security for a number of U.S. government agencies.

#### Micro and nano devices and systems

Sandia performs research and development at the nanoscale and microscale that spans the breadth of physical, chemical, and biological sciences. Building upon this research, Sandia engineers invent, design, produce, and test trusted microelectronics, photonics, and microsystems capable of operating in extreme environments. This capability is centered in Sandia's MESA facility, multidisciplinary microsystems competencies, and nanoscience facilities and competencies. Full integration and success requires partnerships across Sandia to provide distinguishing and disruptive science and technology solutions to meet national security needs.

**Key examples:** Research through production of radiation-hardened application-specific silicon integrated circuits and heterojunction bipolar compound semiconductor transistors; research through technology transfer

of DARPA-funded technologies (e.g., the chip scale atomic clock and the micro gas analyzer); and development of technology portfolios that enable Sandia's mission areas (e.g. microsystems enabled photovoltaics and silicon photonics).



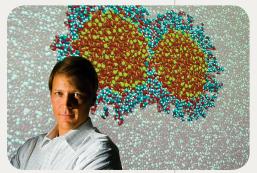
#### Modeling and simulation and experiment

Sandia engineers simulate the behavior of complex systems and environments through a combination of computational modeling and experiments with high fidelity and resolution to enable understanding of complex physical and engineering systems.

Experimental discovery provides foundational understanding that is captured in subgrid physics models and material models for integration in scientific simulation codes. As one important example, facilities capable of compressing energy in space and time to create physical environments, processes, and radiation output relevant to nuclear weapons play a major role in Sandia's mission. Facilities such as Z provide data that improve and validate the codes that support our nuclear weapons work, test the judgment and skill of our staff, and aid in determining the vulnerability of our weapons to harsh radiation environments. *Computational simulation* captures our best understanding of the relevant physical processes to enable virtual exploration of engineered systems in demanding environments. Advanced algorithms and some of the world's fastest computers allow the use of Sandia's computational simulation codes to explore scenarios and system responses not practical to explore experimentally. Major environmental test facilities are used to validate full-system computer simulations.

**Key example:** The "always-never" aspect of nuclear weapons control and safety allows no room for error and requires understanding of possible failure mechanisms and margins before they are encountered. A close coupling between computing and experiments allows for quantified understanding of margins and uncertainties and truly predictive science.

#### Natural and engineered materials



Sandia engineers strive to understand the behavior of materials—engineered, biological, and geological—at a fundamental level and to scientifically tailor the materials and processes to achieve desired mission system performance. Among material properties important to Sandia systems performance are physical and geophysical, chemical, electrical, optical, biological, fluid flow, and radiological properties.

**Key examples:** The ability to provide fundamental understanding of the material, structure, process, and performance relationship; the ability, through models and experiment, to understand and predict the relationship of mission-relevant

materials with their environment; the ability to create and scientifically tailor new and existing materials and material systems for defined performance parameters; and the ability to characterize and analyze—both *in situ* and in the lab—materials structure and performance at multiple (atomic through macro) scales.



#### **Pathfinders**

Pathfinders are advanced systems that help solve significant technical challenges of national interest. Resulting from ambitious, bold, and creative technical work, pathfinders explore new technologies and system concepts. These innovative systems illustrate the Laboratories' ability to conceive and demonstrate advanced concepts that support evolving mission requirements, reduce technological risk, shape new programs, and transfer technology to the private sector. This capability includes prototype design, analysis, development, testing, and evaluation of advanced offensive and defensive military and intelligence systems.

**Key examples:** Strategic and tactical space-based optical systems, advanced hypersonic flight vehicles, and high-resolution real-time SAR systems, prototypical orbit launch vehicles, and new directed energy weapons.

#### Safety, risk, and vulnerability analysis

Sandia creates innovative and quantitative approaches to safety, risk, and vulnerability analyses applied to critical systems, infrastructures, proliferation, and catastrophic events. Our approaches and technologies have been applied to critical civilian and military assets and infrastructure, both domestically and internationally. Sandia also provides vital expertise and technical assistance to the government in the potential proliferation of materials and technologies associated with weapons of mass destruction.

**Key examples:** The Joint Integrated Life-Cycle System (JILS), a risk assessment approach that informs security-trades across the enterprise; risk and vulnerability assessments of physical security systems for high-value assets including nuclear weapons and critical infrastructure; assessments and response to the proliferation of nuclear materials and technologies, including active members of the Nuclear Incident Response Program (NIRP) which responds to an improvised nuclear device threat to our nation.

#### **Conclusions**

This plan is a living document and a guide for action. Sandia leadership reviews and modifies the *Strategic Plan* to align with our current customers and future national security needs. Each summer, Sandia establishes multi-year goals and annual milestones for the upcoming fiscal year, and, through line-of-sight mechanisms, communicates these to members of the workforce for their annual performance management. Each quarter, Laboratory Leadership Team reviews progress on goals and milestones and provides an annual status report to Lockheed Martin Corporation, Department of Energy, and the National Nuclear Security Administration.

As the *FY12-FY16 Strategic Plan* allowed us to successfully establish the Laboratories' framework, this plan will help evolve that framework into well-articulated mission area strategies, which will drive the priorities and future sustainability of the Laboratories. We will continuously improve this planning process and its products so that every Sandian can ensure mission success now and in the future.

#### **Acknowledgments**

Special thanks to the center directors and their teams for their dedicated work in refining the strategic goals for each objective and developing and articulating the new Laboratories' framework. We would also like to thank the Laboratories' communications team and members of the Executive Support Division for their significant effort to publish this plan.

Sandia National Laboratories is a multiprogram laboratory operated and managed by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration.

Additional information on the Sandia strategic planning process is available on the Sandia Techweb at http://strategicplan.sandia.gov



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